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GB 0213069.8

By virtue of a direction given under Section 30 of the Patents Act 1977, the application is proceeding in the name of

STACEY OIL SERVICES LIMITED,
16 Albyn Place,
ABERDEEN,
AB9 1PS,
United Kingdom

Incorporated in the United Kingdom,

[ADP No. 08488694001]



1/77

08JUN02 E724138-4 010002
P01/7700 0.00-0213069.8

Request for grant of a patent

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07 JUN 2002

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1. Your reference

sot.2323.uk.dk/ac.b

2. Patent application number

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07 JUN 2002

3. Full name, address and postcode of the or of each applicant (underline all surnames)

Stacey Oil Tools Limited
Unit AJ, Badentoy Crescent
Badentoy Park Industrial Estate
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ABERDEEN
AB12 4YD
United Kingdom
UK

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

SECTION 30(1)(977 ACT) APPLICATION FILED 9/10/02
8398612001

4. Title of the invention

Rotating diverter head

5. Name of your agent (if you have one)

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

Kennedys Patent Agency Limited
Floor 5, Queens House
29 St Vincent Place
GLASGOW
G1 2DT
United Kingdom

Patents ADP number (if you know it)

805 8240002

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number
(if you know it)

Date of filing
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7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing
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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

Yes

- a) any applicant named in part 3 is not an inventor, or
 - b) there is an inventor who is not named as an applicant, or
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Description 12 ✓

Claim(s)

Abstract

Drawing(s) 3 + 3 ^{MSC}

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Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

11.

I/We request the grant of a patent on the basis of this application.

Signature
KENNEDYS

Date
6 June 2002

12. Name and daytime telephone number of person to contact in the United Kingdom

David Kennedy
tel: 0141 226 6826

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1 Rotating diverter head

2

3 The present invention relates equipment used in the
4 drilling of oil, gas and geothermal wells and in
5 particular, though not exclusively, to a rotating
6 diverter head which includes an inlet flange on which the
7 head can rotate to adjust the location of a side outlet.

8

9 In drilling a well, a drilling tool or "drill bit" is
10 rotated under an axial load within a bore hole. The
11 drill bit is attached to the bottom of a string of
12 threadably connected tubulars or "drill pipe" located in
13 the bore hole. The drill pipe is rotated at the surface
14 of the well by an applied torque which is transferred by
15 the drill pipe to the drill bit. As the bore hole is
16 drilled, the hole bored by the drill bit is substantially
17 greater than the diameter of the drill pipe. To assist
18 in lubricating the drill bit, drilling fluid or gas is
19 pumped down the drill pipe. The fluid jets out of the
20 drill bit, flowing back up to the surface through the
21 annulus between the wall of the bore hole and the drill
22 pipe.

1 The density of the drilling fluid is adjusted such that
2 the pressure head produced by the weight of the column of
3 drilling fluid is slightly more or less than the pressure
4 of the oil or gas encountered in the geological
5 formations being drilled through. If the pressure head
6 of the column of drilling fluid is greater than the
7 pressure of the oil or gas, the top of the well can be
8 open to atmosphere. It is often advantageous to allow
9 the pressure head of the drilling fluid to be slightly
10 less than the pressure of the oil or gas encountered in
11 the formation. In this case, known as "underbalanced
12 drilling", the annulus around the drill pipe needs to be
13 sealed and the drilling fluid returning under pressure up
14 the annulus must be diverted to a recirculating unit for
15 pumping back down the well.

16

17 Rotating diverter heads provide a means of sealing off
18 the annulus around the drill pipe as the drill pipe
19 rotates and translates axially down the well while
20 including a side outlet through which the return drilling
21 fluid is diverted. Such rotating diverter heads may also
22 be referred to as rotating blow out preventers or
23 drilling heads. These units generally comprise a
24 stationary housing or bowl including a side outlet for
25 connection to a fluid return line and an inlet flange for
26 locating the unit on a blow out preventer or other
27 drilling stack at the surface of the well bore. Within
28 the bowl, opposite the inlet flange, is arranged a
29 rotatable assembly such as anti-friction bearings which
30 allow the drill pipe, located through the head, to rotate
31 and slide. The assembly includes a seal onto the drill
32 pipe which is typically a strip of rubber.

33

1 Prior art rotatable diverter heads such as those
2 disclosed in US Patent Nos. 4949796, 5662181, 5848643,
3 5647444, 4480703 and 4312404 have concentrated on
4 improvements to the sealing means, in particular the ease
5 to which the rubber strips can be replaced. In all these
6 diverter heads the side outlet are included in the
7 housing of the stationary bowl and the rotatable
8 assemblies are mounted above the side outlet to aid
9 disassembly for maintenance.

10

11 A disadvantage of these prior art diverter heads is that
12 as the bowl is bolted or clamped to the blow out
13 preventer, the side outlet is fixed at a single position.
14 The pipework forming the return fluid line must attach to
15 the side outlet and as both are generally fixed in
16 position and orientation it is difficult to mate their
17 respective flanges together.

18

19 It is therefore an object of the present invention to
20 provide a rotating diverter head which can be rotated to
21 re-position the side outlet with respect to the inlet
22 flange.

23

24 It is a further object of the present invention to
25 provide an improved method of connecting a rotating
26 diverter head to a return fluid line at a blow out
27 preventer.

28

29 According to a first aspect of the present invention
30 there is provided a rotating diverter head comprising:

31

1 a bowl member having a first bore aligned on a central
2 axis therethrough and a second bore located
3 substantially transverse of the central axis;

4
5 a housing located substantially within the bowl member
6 including first rotational means to rotate the housing
7 relative to the bowl member and first sealing means to
8 sealably engage the housing upon a drill pipe when the
9 drill pipe is inserted through the first bore; and

10
11 an inlet flange for connecting the bowl member to a
12 blow out preventer stack, the flange including second
13 rotational means to selectively rotate the bowl member
14 about the central axis.

15
16 By allowing the bowl member to rotate relative to the
17 inlet flange and hence the blow out preventer stack, the
18 second bore can be rotated on the central axis to aid
19 alignment with a return flow line.

20
21 Preferably the second rotational means comprises
22 interconnected screw threads between the flange and the
23 bowl member.

24
25 Preferably also the flange further includes second
26 sealing means to prevent the egress of fluid from the
27 first bore through the second rotational means. The
28 second sealing means may be an o-ring or other rubber
29 based seal.

30
31 Preferably the flange further includes locking means for
32 preventing rotational movement of the bowl member with
33 respect to the flange when the second bore is aligned.

1 Advantageously the locking means comprises a locking ring
2 arranged around the bowl member and engageable on the
3 screw threads.

4
5 Preferably the housing including first sealing means and
6 first rotational means is as known in the art. Examples
7 of such housings are disclosed in US Patent Nos. 4949796,
8 5662181, 5848643, 5647444, 4480703 and 4312404, the
9 contents of which are incorporated herein by reference.

10

11 According to a second aspect of the present invention
12 there is provided a bowl for use in a rotatable diverter
13 head, the bowl comprising a substantially cylindrical
14 body having a bore there through adapted for receiving a
15 housing, rotatable therein and sealable to a drill pipe
16 passed there through, and an inlet flange, the body and
17 flange being rotatably coupled such that the body rotates
18 on a longitudinal axis of the bore when the flange is
19 attached to a blow out preventer stack.

20

21 Preferably the body and flange are rotatably coupled by
22 interconnected screw threads on an outer surface of the
23 body and an inner surface of the flange.

24

25 Preferably also the flange further includes sealing means
26 to prevent the egress of fluid from the bore through the
27 rotational coupling. The sealing means may be an o-ring
28 or other rubber based seal.

29

30 Preferably the flange further includes locking means for
31 preventing rotational movement of the body with respect
32 to the flange when the desired. Advantageously the

1 locking means comprises a locking ring arranged around
2 the body and engageable on the screw threads.

3

4 According to a third aspect of the present invention
5 there is provided a method of connecting a rotating
6 diverter head to a return fluid line at a blow out
7 preventer stack, the method comprising the steps:

8

9 (a) connecting an inlet flange of the diverter head to
10 an outlet of the blow out preventer stack;

11

12 (b) rotating the diverter head with respect to the blow
13 out preventer stack to align a side outlet of the
14 head with a return fluid line; and

15

16 (c) connecting the side outlet to the return fluid line.

17

18 Advantageously the method includes the step of locking
19 the diverter head in position to prevent rotation of the
20 diverter head relative to the blow out preventer after
21 the side outlet is aligned.

22

23 An example embodiment of the present invention will now
24 be described, by way of example only, with reference to
25 the accompanying drawings of which:

26

27 Figure 1 is an isometric view of a rotating diverter head
28 according to an embodiment of the present invention;

29

30 Figure 2 is a cross sectional view taken vertically
31 through the head of Figure 1;

32

1 Figure 3 is a side view of the head of Figure 1 mounted
2 on the top of a blow out preventer stack; and

3

4 Figures 4 and 5 are top views of the head of Figure 1
5 illustrating first and second alignment positions of the
6 side outlet.

7

8 Reference is initially made to Figures 1 and 2
9 illustrating a rotating diverter head, generally
10 indicated by reference numeral 10, in accordance with an
11 embodiment of the present invention.

12

13 Head 10 includes a bowl 11 which is generally a
14 cylindrical body, a rotating spindle 12, an inlet flange
15 14 and a side outlet 16. Spindle 12 forms a housing which
16 rotates in anti-friction bearings 18. Spindle 12 also
17 includes a seal 20 which sealably engages a drill pipe 22
18 located through the head 10.

19

20 In the prior art diverter heads these features are found
21 with the bowl and flange typically being of single piece
22 construction and thus referred to as a stationary

23 housing. As can be seen in Figure 2, the bowl 11 and
24 flange 14 are separate pieces in the present invention.

25 It is the arrangement of the flange 14 and bowl 11 which
26 relate to the present invention and thus the spindle 12
27 together with its bearing 18 and sealing means 20 may be
28 of any type as is known in the art. For clarity one
29 embodiment of a spindle 12 will be described herein,
30 however recognition that any arrangement of spindle 12
31 could be used with/in the present invention, will be
32 appreciated.

33

1 In the embodiment shown, head 10 comprises a cylindrical
2 body or bowl 11, located upon a flange 14. Bowl 10 has an
3 outer surface 24 upon which are located lugs 26 for

4 lifting and positioning the head 10 on a blow out
5 preventer stack (not shown). Flange 14 has a base 28
6 compatible with the top flange of the blow out preventer
7 stack and the two are linked via screws located in ports
8 30. The dimensions of the base 28 of the flange 14 are
9 determined by an international standard to ensure proper
10 mating with other flanges of the same size and pressure
11 rating. Once positioned the flange 14 is fixed in
12 relation to the blow out preventer stack. A seal groove
13 32 on the bottom face 34 of the base 28 provides for an
14 o-ring to be inserted to prevent the egress of fluid from
15 the head 10 between the base 28 and the blow out
16 preventer stack.

17
18 The bowl 11 and flange 14 provide a bore 36 on a central
19 axis 38 through the head 10. The side outlet 16 is
20 arranged to direct fluid in a perpendicular direction
21 from the central bore 36. The bowl 11 and the flange 14
22 mate between a respective inner surface 40 of the bowl 11
23 and an outer surface 42 of the flange 14. The inner
24 surface 40 includes a threaded bore 44 and a sealing bore
25 46. The diameter of sealing bore 46 is less than the
26 diameter of threaded bore 44. The outer surface 42 of
27 flange 14 includes a threaded section 48 and a sealing
28 section 50. The threads of threaded section 48 engage
29 the threads of threaded bore 44 of bowl 11. The sealing
30 section 50 comprises a seal groove 52 into which is
31 located an o-ring or rubber strip (not shown). When the
32 threads of the threaded bore 44 engage the threads on the
33 threaded section 48, the sealing section 50 locates

1 against the sealing bore 46, thus providing sealing
2 engagement between the bowl 11 and the flange 14 to
3 prevent the egress of fluid from the head 10 at this
4 location. The seal will be maintained as the threads are
5 moved relative to each other so that the bowl 11 can
6 rotate on the central axis 38 relative to the flange 14.
7 This rotation is selective and continuous through 360
8 degrees around the central axis.

9

10 Located around the flange 14 is a locking ring 54. Ring
11 54 is a threaded lock ring which comprises a threaded
12 inner surface 56 that engages threaded section 48 of
13 flange 14. Ring 54 can be rotated upwards towards the
14 base 58 of bowl 11 to prevent movement of the bowl 11 and
15 thus lock the bowl 11 to the flange 14.

16

17 Toward an upper end 60 of bowl 11 is located a spindle 12
18 or housing. Spindle 12 includes a through bore 62 located
19 on the central axis 38. A drill pipe 22 may extend
20 axially through the bore 62. Spindle 12 includes a
21 stripper 64 as is known in the art. Stripper 64 comprises
22 a molded, resilient seal 20 having a through-hole 66 and
23 a flange 68. The nominal diameter of through-hole 66 is
24 somewhat smaller than the diameter of drill pipe 22 such
25 that the inner surface 70 of the through-hole 66 sealably
26 engages the outer diameter 72 of the drill pipe 22.

27 Spindle 12 further comprises a carrier 74. Carrier 74 has
28 a cylindrical body providing a through-hole 76 concentric
29 to the central axis 38 and an outer surface 78. Flange 68
30 seals against the carrier 74. At the outer surface 78 of
31 carrier 74 is located a bearing housing 80. Carrier 74 is
32 sealably engaged to bearing housing 80. However, in one
33 or more embodiments the carrier 74 may be disengageable

1 from the bearing housing 80 so that the seal 20 of the
2 stripper 64 can be easily removed from the head 10 for
3 maintenance or replacement. Housing 80 includes anti-
4 friction bearing 18 which allow the bearing housing 80 to
5 rotate within the bowl 11. By their engagement, when
6 housing 80 rotates the stripper 64 and carrier 74 will
7 rotate in a fixed relationship. Thus the spindle 12 can
8 rotate within the bowl 11 while maintaining a seal
9 against the drill pipe 22 passing there through. Thus the
10 drill pipe 22 can rotate or reciprocate unheeded through
11 the head 10. The seal 20 also ensures that fluid
12 travelling up bore 36 is directed through the side outlet
13 16 for re-circulating down the drill pipe 22.

14
15 Reference is now made to Figures 3 through 5 which
16 illustrate the rotating diverter head 10 in use. To
17 operate, lock ring 54 is threaded onto threaded section
18 48 of flange 14. Flange 14 is threaded into bowl 11
19 until face 86 of flange 14 contacts face 88 of bowl 11.
20 Lock ring 54 is threaded until it contacts the base 58 of
21 bowl 11. The rotating diverter head 10 is mounted onto
22 annular blowout preventer 82 of a stack (not shown) using
23 lugs 26 to assist its movement. Head 10 is fixed to blow
24 out preventer 82 by mating flange 14 to outlet flange
25 connection 84 of annular blowout preventer 82 using
26 threaded studs located through ports 30.

27
28 A return flow line 90 is attached to an outlet flange 92
29 of the side outlet 16, as is shown in Figures 3 and 5.
30 Flow line 90 is typically a section of fixed piping
31 connected to a separator (not shown). referring now to
32 Figure 4, if flow line 90 is not aligned with outlet
33 flange 92, i.e., if the axis 94 of flow line 90 is not

1 co-linear with the axis 96 of outlet flange 92, the head
2 10 must be rotated about the central axis 38 until the
3 axis 96 of outlet flange 92 is co-linear with the axis 94
4 of flowline 90.

5
6 Rotating diverter head 10 is rotated about its vertical
7 axis on the central axis 38 by unthreading lock ring 54,
8 rotating bowl 11 on the threads of the threaded bore 44
9 against the threads of threaded section 48 of flange 14,
10 until the axis 96 of outlet flange 92 is co-linear with
11 the axis 94 of flowline 90. Lock ring 54 is then threaded
12 upward and tightened against the base 58 of the bowl 11.

13
14 In prior art diverter heads the inlet flange is either
15 welded or otherwise immovably and permanently attached to
16 bowl. This means that the relationship between the inlet
17 flange and the side outlet is fixed preventing movement
18 of the side outlet to aid alignment with a return flow
19 line. Therefore an advantage of the present invention is
20 that it provides a rotating diverter head where the side
21 outlet can be re-aligned when the head is connected to a
22 blow out preventer.

23
24 A further advantage of the present invention is that it
25 provides a diverter head in which the inlet flange may be
26 interchangeable so that the size and pressure rating of
27 the diverter head can be varied without the need to
28 change the spindle.

29
30 Modifications may be made to the invention herein
31 described without departing from the scope thereof. For
32 example, the threaded bore and threaded section may be
33 replaced by a pin and groove arrangement. The groove

- 1 being a spiral into which the pin may travel
 - 2 circumferentially around the inner or outer surface of
 - 3 the flange or bowl, respectively.
-

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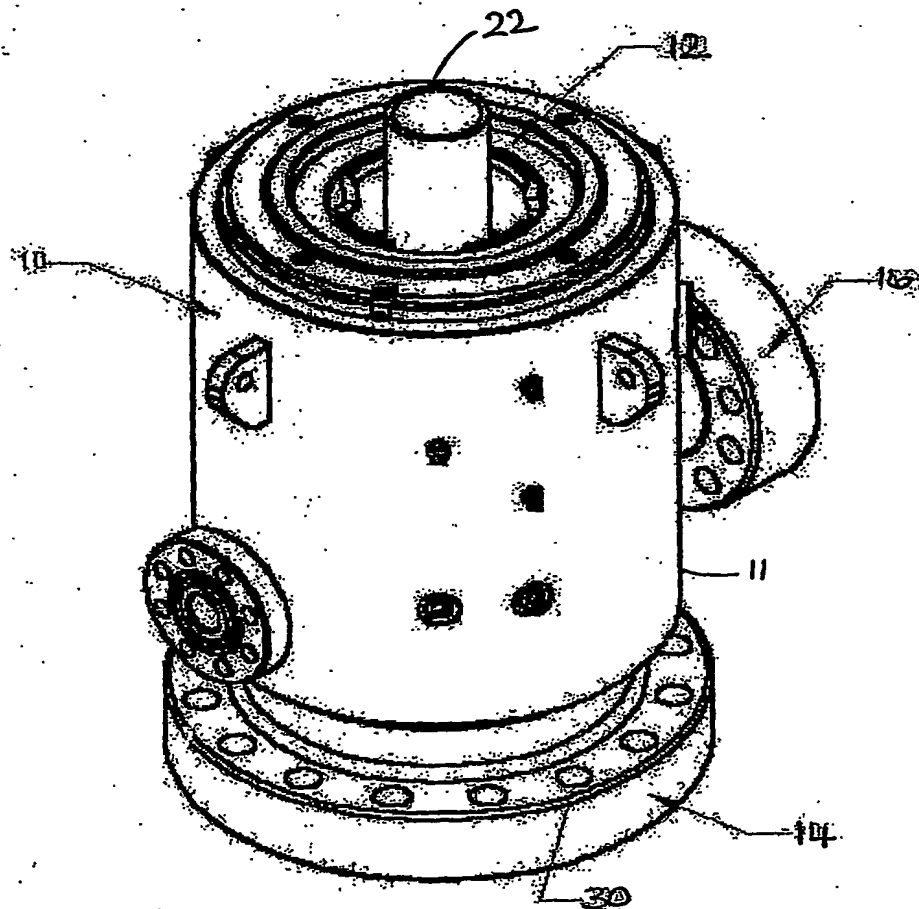


FIGURE 1

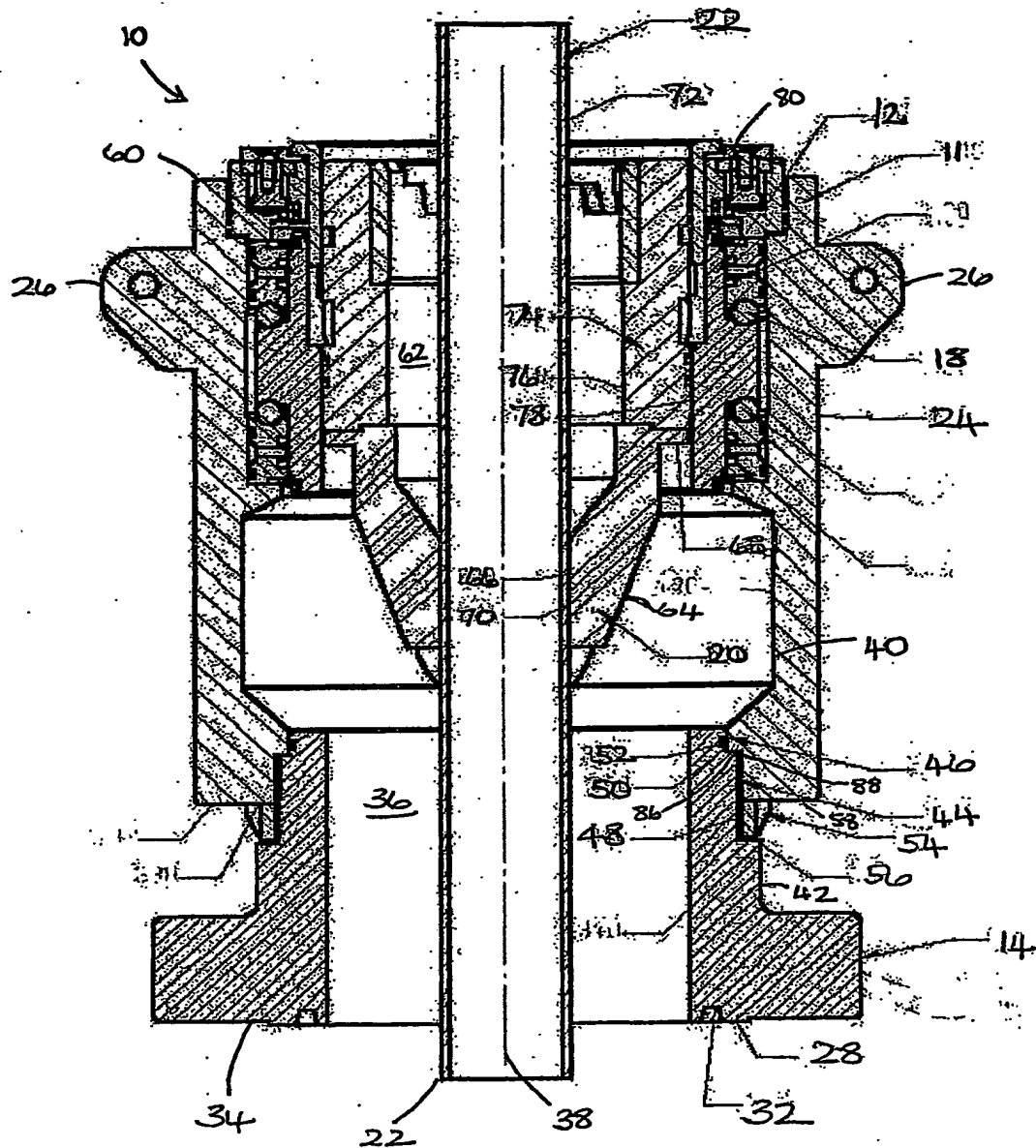


Figure 2

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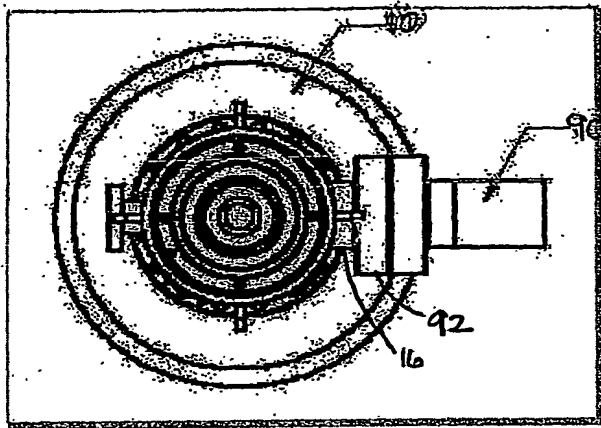


Figure 4

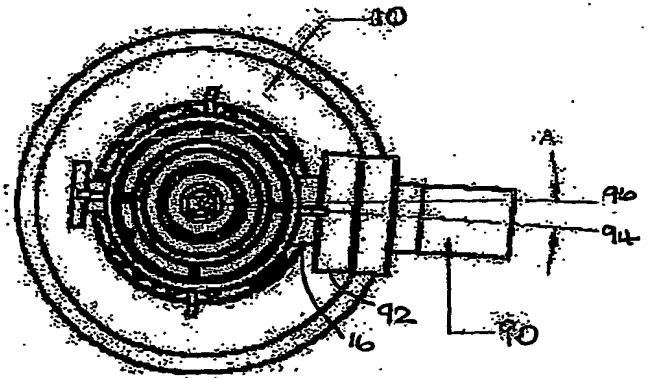


Figure 5

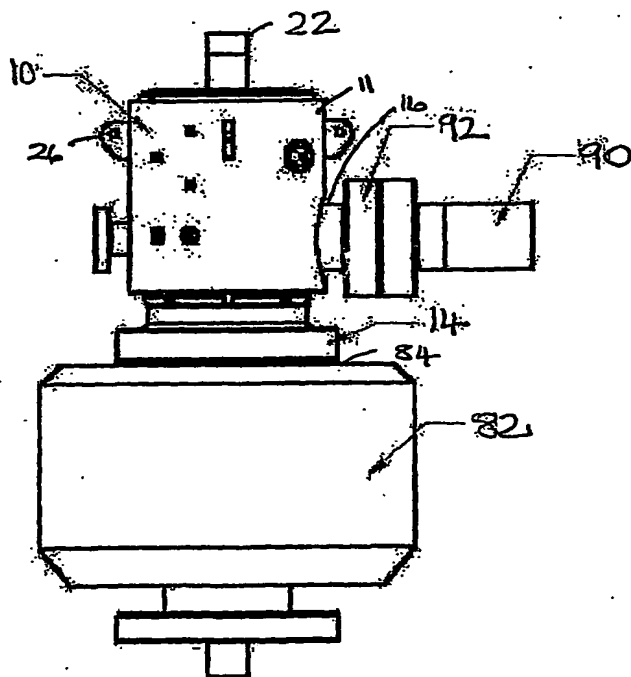


Figure 3

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